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Published in:
Environmental Archaeology

DOI:
[10.1080/14614103.2017.1385890](https://doi.org/10.1080/14614103.2017.1385890)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2019

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Çakırlar, C., & Marston, J. (2019). Rural Agricultural Economies and Military Provisioning at Roman Gordion (Central Turkey). *Environmental Archaeology*, 24(1), 91-105.
<https://doi.org/10.1080/14614103.2017.1385890>

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Environmental Archaeology

The Journal of Human Palaeoecology

ISSN: 1461-4103 (Print) 1749-6314 (Online) Journal homepage: <http://www.tandfonline.com/loi/yenv20>

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To cite this article: Canan Çakırlar & John M. Marston (2019) Rural Agricultural Economies and Military Provisioning at Roman Gordion (Central Turkey), Environmental Archaeology, 24:1, 91-105, DOI: [10.1080/14614103.2017.1385890](https://doi.org/10.1080/14614103.2017.1385890)

To link to this article: <https://doi.org/10.1080/14614103.2017.1385890>



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Rural Agricultural Economies and Military Provisioning at Roman Gordion (Central Turkey)

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ABSTRACT

Roman Gordion, on the Anatolian plateau, is the only excavated rural military settlement in a pacified territory in the Roman East, providing a unique opportunity to investigate the agricultural economy of a permanent Roman garrison. We present combined results of archaeobotanical and zooarchaeological analyses, assessing several hypotheses regarding Roman military provisioning. The garrison adapted its dietary preferences to local agricultural systems, but maintained its traditional meat supply of pork, beef, and chickens as well. There is evidence for economic interdependence with local farmers and cattle herders, self-sufficiency in pork and chicken production, and complex relationships with autonomous sheep and goat herders who pursued their own economic goals. If the Roman military in Gordion exercised a command economy, they were able to implement that control only on specific components of the agricultural sector, especially cereal farming. The sheep and goat herding system remained unaltered, targeting secondary products for a market economy and/or broader provincial taxation authorities. The garrison introduced new elements to the animal economy of the Gordion region, including a new pig husbandry system. Comparison with contemporary non-military settlements suggests both similarities and differences with urban meat economies of Roman Anatolia.

ARTICLE HISTORY

Received 15 May 2017

Accepted 22 September 2017

KEYWORDS

Agriculture; military provisioning; archaeobotany; zooarchaeology; Roman; Anatolia

Introduction

The recent identification of the site of Gordion as a military fort during the imperial Roman period, the first such site discovered in Anatolia (modern Turkey), provides an opportunity to investigate for the first time the provisioning of a permanent, rural military settlement located within pacified provincial territory in the Roman East (Bennett 2013; Bennett and Goldman 2009; Goldman 2007). Gordion is additionally unique in that botanical and faunal remains were systematically collected during excavation of its Roman levels, and we present the combined results of both archaeobotanical and zooarchaeological analyses here to assess the economy of military provisioning, the agricultural strategies employed locally to meet military demands, and the regional environmental implications of these agricultural practices.

Rural agricultural economies in much of the eastern Mediterranean during the Roman period remain poorly understood, in contrast to other areas of the Mediterranean (especially the Italian peninsula and Egypt) and the northwestern European provinces, where abundant documentary records and archaeological evidence provide important insights into land-holding systems and farming practices (e.g. Bagnall

1992; King 1984; Kron 2000, 2012; MacKinnon 2010; Monson 2012; Stallibrass and Thomas 2008 and the chapters therein). Our understanding of rural agricultural economies is hampered by several factors beyond the lack of local documentary records. Recovery and analysis of plant and animal remains from archaeological contexts has been limited from Classical sites in Anatolia, leaving many key settlements without substantial publication of primary data on agricultural economies (e.g. Ancyra, Pessinus, Daskyleion). Even where those data have been collected and analysed (e.g. faunal remains from Sagalassos [De Cupere 2001; Fuller et al. 2012]), faunal and botanical remains, which record distinct strategies of animal husbandry and plant cultivation, have not been integrated directly, as is a challenge worldwide (Smith and Miller 2009; VanDerwarker and Peres 2010).

This paper draws on assemblages of plant and animal remains from Roman Gordion, in central Anatolia (Figure 1), to reconstruct aspects of agricultural economies at a rural military encampment, offering a first insight into the provisioning of the Roman military in Anatolia. We integrate new faunal analyses with recently published botanical remains (Marston and Miller 2014) to identify agricultural strategies and

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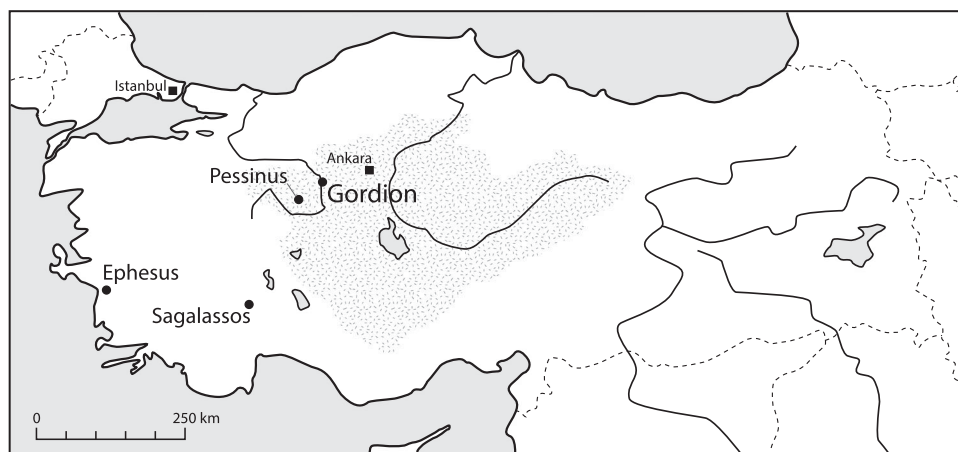


Figure 1. Map of Anatolia including comparative sites mentioned in the text. Hatched area is the Central Anatolian Plateau.

provisioning systems, as well as local environmental implications of these strategies. We assess several hypotheses regarding Roman military provisioning with specific reference to Roman Anatolia, and conclude that there is evidence for multiple agricultural economies involved in the provisioning of Gordion.

Roman agriculture and provisioning

Roman agricultural economies in Anatolia

Not much is known about Roman agricultural economies in Anatolia. Contemporary archaeobotanical and zooarchaeological datasets are scarce and fragmentary, while texts are nearly absent.

Sagalassos, the important urban centre of Roman Psidia, has layers contemporaneous to Gordion (inhabited during the Early to Middle Imperial periods, c. 25 BCE – 300 CE) and is the best described Roman site in Anatolia, save Gordion, with regard to environmental archaeological data, although botanical data have been presented only in summary form (De Cupere 2001; De Cupere et al. 2017; Frémondeau et al. 2017; Fuller et al. 2012, 162). These data indicate that during Early to Middle Imperial periods, both agriculture and animal husbandry became more intensive (more wheat, more pork, intensive use of cattle as labour) in relation to the Classical Hellenistic period, based on evidence from the nearby site of Düzen Tepe. While sheep and goat, kept primarily for their secondary products (milk and wool/fleece), were also primary meat providers to the city, there is evidence that arboriculture, overgrazing, and forest clearance led to significant environment change (Kaniewski et al. 2007; Vermoere 2004; Vermoere et al. 2002).

The picture from the Roman city of Pessinus, situated only ca. 50 km west of Gordion, is much less clear, because it is illustrated only by faunal data, but Pessinus is by proximity and environment more relevant. The relative abundance of sheep and goat is higher than at Sagalassos, while pigs are less abundant, and there is

evidence for the use of sheep and goat for secondary products and the use of cattle for labour. Chicken remains are common at Pessinus, approximately half as numerous as pig by NISP (De Cupere 1995).

Other related faunal data from Roman Anatolia likewise come from large Roman cities, such as Didyma, located far away from Gordion and by the coast. These data are patchy – collected over decades by various people and published to discuss the nature and function of certain locations or neighbourhoods within the cities or their territories, rather than to explain agriculture and provisioning of the cities or their territories as a whole. Therefore, besides Sagalassos and Pessinus, in our discussion we refer to only one recently published contemporary context from Ephesus (Forstenpointner, Galik, and Weissengruber 2010) as representative of an elite household in a well-watered part of Roman Asia Minor. Sadly, botanical data are not available from either Pessinus or Ephesus.

Provisioning at Roman military sites

Since the Roman army was a populous group vital to the workings of the empire, its economic strategies and economic impact has been a topic of major interest for historians and archaeologists (Bennett 2013; Davies 1971; Stallibrass and Thomas 2008). Written sources are clear about the varied diet of the Roman soldiers and the various ways soldiers acquired their food: from hunting and extortion to raising crops and keeping herds, depending on the different situations they lived in, whether embedded in an urban environment, in an ephemeral camp, and engaged in conflict, policing, or building infrastructure (Davies 1971). The mechanisms that govern the military's diverse provisioning strategies, especially in the eastern provinces, however, remain unclear.

Archaeological inquiries that draw on zooarchaeological and archaeobotanical data to explore how the Roman military was provisioned are mainly restricted to western Europe and Britain (e.g. King 1984, 1999a;

Stallibrass and Thomas 2008). These reports highlight several aspects of military provisioning that differ from plant and animal use at civilian sites, including especially an emphasis on pork and beef in the military diet (King 1984, 1999a, 1999b). This trend, however, is regionally variable, with increased abundances of sheep and goat bones found at sites in the Mediterranean region of France (King 1984, 1999a).

Unfortunately, only one published set of faunal remains reflects directly military subsistence in the Roman East: the bone assemblages from military sites of the *Limes Arabicus* in modern Jordan during the Late Roman Period (3rd–6th centuries AD; Toplyn 1994, 2006). These remains indicate a meat supply centred on sheep, goats, and chickens, and Toplyn (1994) concludes that the soldiers stationed along the limes were primarily responsible for raising these animals. The botanical remains from Lejjun, one of the sites investigated by Toplyn, indicate a variety of cultivated plants that were farmed locally, evidently by the soldiers (Crawford 2006). Crawford suggests that wheat is underrepresented in the archaeobotanical assemblage in comparison to barley, due to the use of barley in animal feed and subsequent preservation in animal dung burned as fuel, but that both cereals were farmed locally (Crawford 1987, 2006). She finds support for overgrazing of local landscapes and possible limited irrigation for fruit production. Together, these data indicate that the garrison fully provisioned itself, likely due to local origins for many of these soldiers (Toplyn 1994).

These data suggest multiple patterns we might find in the archaeobotanical and faunal datasets from Gordion. Like military garrisons in Europe, Gordion may have been provisioned with select foods, including high-value beef and pork, as suggested by Bennett (2013) and comparanda from Roman Europe (King 1984, 1999a). At the other extreme, the soldiers at Gordion could have been farmers and herders themselves, tending their own fields and flocks, with an emphasis on crops suitable for local production including barley and wheat, sheep and goats, as seen at Lejjun (Crawford 1987, 2006; Toplyn 1994, 2006). More likely is a middle ground, given Gordion's location in the eastern Mediterranean but along a major transportation route between major cities, rather than on the peripheral boundary of the Roman world, as was Lejjun. In the discussion below we return to these hypothesised patterns and their usefulness in understanding Roman Gordion.

Gordion during the Roman period

Biogeography and environment

Gordion is situated in the northwestern Anatolian Plateau, an uplifted landform that supports a semi-arid

environment throughout central Anatolia (Atalay 1997). This area is comprised of a series of dry plateaus cut by river valleys and volcanic massifs that provide variation in elevation, rainfall, and plant communities (Figure 2). Rainfall is correlated with elevation, with more rain at higher elevations supporting dense forests of pine, oak, and juniper above 1400 m above sea level (masl), while open 'steppe-forest' grassland communities dominate in drier, lower regions (Atalay 2001; Marston 2017; Marston and Branting 2016; Zohary 1973). Gordion sits at one of the lowest elevations in the region, at 680 masl along the Sakarya River, and currently receives an average of less than 350 mm of rain per year. Present vegetation communities in the Gordion region include riparian vegetation along the Sakarya and Porsuk Rivers, xeric grasslands below 900 masl, and scrub juniper-oak woodland with increasing density of trees above 900 masl, which grades into canopy forest of oak, pine, or juniper above 1200–1400 masl depending on soil and aspect (Marston 2017; Miller 2010).

Much of the landscape surrounding Gordion today is dedicated to agricultural production. The advent of river canalisation and mechanised agriculture in the 1950s, in addition to government-subsidized irrigation programmes in the 1990s, has transformed the local economy over the last century (Miller 2011, 321). Irrigated wheat, sugar beets, and onions are the primary crops today, although dry-farmed barley and wheat, and rarely chickpea and lentil, are found in areas still not irrigable at present (Gürsan-Salzmänn 2005; Miller 2010, 2011). Traditionally, seasonally transhumant pastoralism of sheep, goats, and cattle were important components of the local economy, but pastoralism has waned in recent years as agricultural yields rise with irrigation and chemical fertilisers, and as household dynamics now favour education and urban employment for children raised in villages, with hired migrant labour for farmlands (Erder, Gürsan-Salzmänn, and Miller 2013; Gürsan-Salzmänn 1997, 2005). Prior to river canalisation in the 1950s, the meanders and oxbows supported a marshy thicket of trees, reeds, and cattails, a habitat that supported a population of wild pigs (Miller 2010, 16).

The landscape of Gordion was different during the Roman period. Geomorphological reconstruction of the region indicates that the Sakarya River has deposited roughly 4 m of alluvial sediment in its floodplain since the Roman period (Marsh 1999, 2005), when it followed a meandering course with a high sediment load resulting from landscape clearance significantly upstream that originated during the earlier Phrygian period (c. 900–550 BCE) (Marston 2015, 2017). Significant portions of the site were eroded and flooded during the Roman period, constraining Roman occupation to the highest portion of the site, although Roman burials are found in areas of the lower town

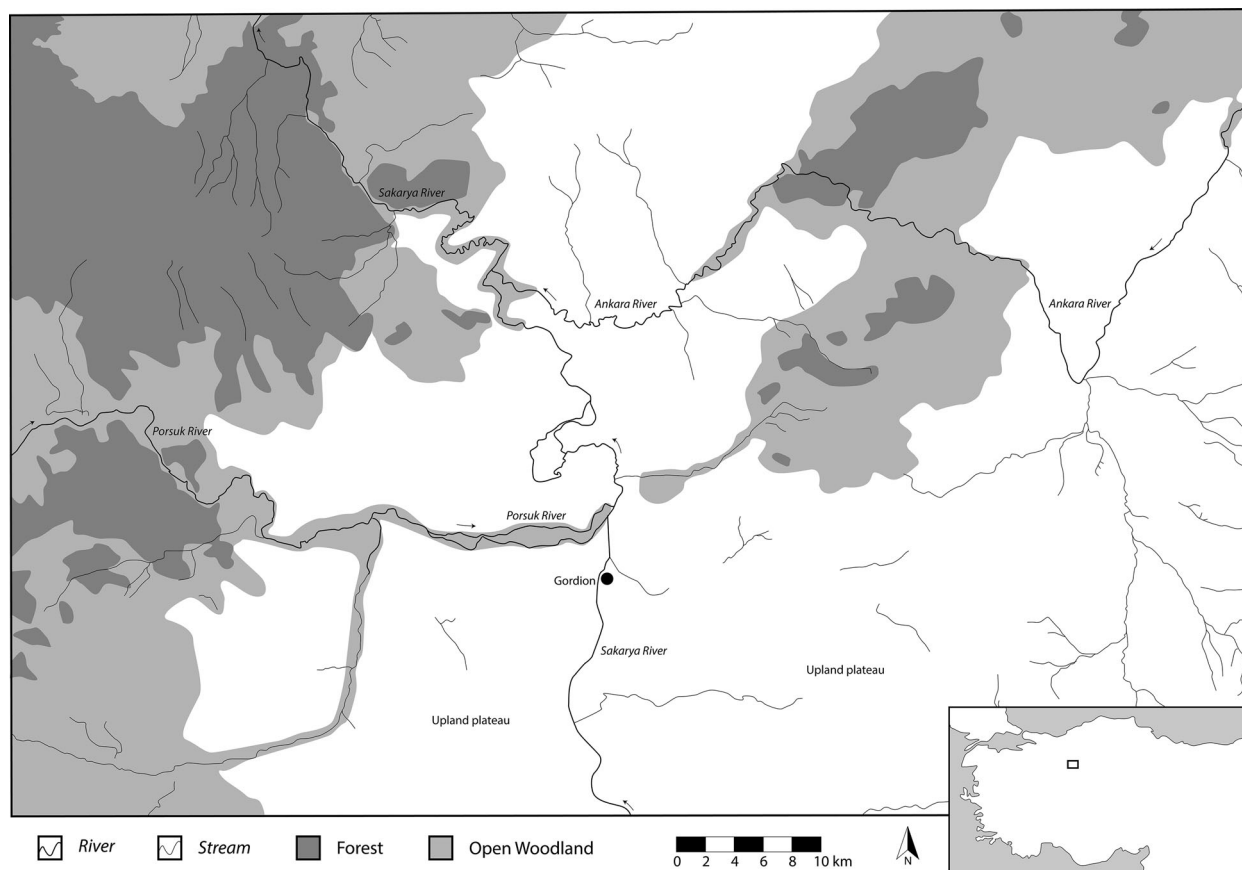


Figure 2. Map of the Gordion region depicting modern geography and woodland distribution. Reprinted with permission of *Journal of Ethnobiology* from (Marston 2015, 590).

(Selinsky 2005; Voigt 2002). Less of the landscape would have been irrigable with only gravity-fed irrigation, with dry-farmed cereal production possible in areas with moisture-retaining basaltic soils (Marsh 2005) and vegetation suitable for extensive grazing present on dry gypsum soils, found especially on local plateaus. We lack a good-quality local proxy paleoclimate dataset, but an aggregation of regional evidence suggests that the Roman period at Gordion was likely slightly warmer and perhaps slightly wetter, or maybe slightly drier, than at present, as considerable regional variation exists among proxy paleoclimate records during this period (Marston 2015, 2017).

Roman Gordion

Our understanding of the chronology and identity of Roman occupation at Gordion has been significantly improved in the last two decades due to the work of Andrew Goldman, who used data from Mary M. Voigt's excavations (1988–2005) and archival research into earlier excavations under Rodney Young (1950–1973) to reconstruct architecture, stratigraphy, and function of the Roman period occupation (Goldman 2000, 2005, 2007, 2010). Goldman's key finding was the identification of a military garrison as the primary, and perhaps only, occupation at Roman Gordion, positioned to manage a key section of the

Roman road linking the provincial capital of Ankara with Pessinus, Dorylaeum, and points further west (Goldman 2007, 2010). Evidence for the garrison dates c. 50–130 CE and includes a barracks structure, unique in Roman Anatolia (Bennett and Goldman 2009); fragments of scale mail, javelin and arrowheads, and hobnail boots (Goldman 2007); and an epitaph of an auxiliary soldier from Pannonia (centred in modern Hungary) dated to c. 113–115 CE by comparative stylistic and historical analysis (Goldman 2010, 142).

Bennett and Goldman (2009) integrate a variety of artifactual and architectural evidence to outline the extent of military installations at Gordion, including a potential second barracks block. It is from these two barracks structures and their immediate external vicinity that the botanical and faunal remains described in this article originate. Bennett and Goldman (2009) have also been able to confirm the identity of the soldiers stationed at Gordion. These soldiers appear to have been auxiliaries who served previously in central Europe, at least some of whom were natives of that region, and who comprised the military unit *cohors VII Breucorum* (Bennett and Goldman 2009; Goldman 2010). Bennett and Goldman (2009, 1612) suggest that Gordion functioned as a storage depot for the Roman army in Galatia, and potentially also for units traversing the province to the eastern front, beginning as early as the Armenian campaign of the 50s CE and extending

through the Parthian Wars of 114–117 CE. This chronology fits well historical evidence for departure of the *cohors VII Breucorum* from Gordion to Cyprus in 116 CE and eventually to Pannonia in the 140s CE, coincident with the final dates for the military garrison structures at Gordion (Bennett and Goldman 2009, 1613).

Drawing on evidence published previously by Marston (2012), Bennett (2013) has argued that the Roman agricultural system evident at Gordion is a direct reflection of provisioning systems designed to supply the Roman military (both the standing garrison of Gordion and units stationed further east) with key staples: wheat for bread, barley for horse feed, and animals for meat, with a preference for beef and pork. Indeed, Bennett identifies two additional putative barrack blocks excavated by Young and argues that the entire site of Gordion may have been a military installation (Bennett 2013, 331–332). As one of the chief duties of a military unit within a pacified province was tax collection, both Bennett (2013, 317, 328) and Goldman (2000, 45) argue that the collection and storage of agricultural products would have been a primary responsibility of this unit, and thus food remains at Roman Gordion are a direct reflection of a military provisioning system. While this hypothesis matches well with botanical evidence from Gordion (Marston 2012; Marston and Miller 2014), the lack of faunal evidence dating to the Roman period in prior zooarchaeological publications from Gordion has rendered the animal provisioning system of this period archaeologically invisible (Miller, Zeder, and Arter 2009; Zeder and Arter 1994). In this study, we present for the first time faunal data from Roman Gordion and address directly the hypotheses laid out by Bennett regarding meat provisioning of the auxiliary garrison stationed at Gordion. In addition, the integration of botanical and faunal data with geomorphological evidence (Marsh and Kealhofer 2014; Marston 2015, 2017) allows us to clarify aspects of land use and landscape change in the Gordion region during the Roman period.

Data and methods

Collection and analysis of faunal remains

All bones discussed here were collected, nominally resulting in collection of all bone fragments larger than 1 cm, although in practice many of the smaller fragments found in sieving appear to have been neglected, and the faunal assemblage instead reflects a typical hand collection strategy. Faunal remains from Roman garrison (Phases 1 to 3) in Gordion were identified by J. Dandoy in 1990s and by one of us (Çakırlar) in 2013 and 2014. Both analysts used a limited comparative skeletal collection and ‘bone manuals’ (e.g. Schmid 1972).

Merging these two datasets, which were collected using somewhat different methodologies as described

further below, and then comparing the merged dataset with published information (mainly NISP and weight) on faunal assemblages from Hellenistic Gordion (Miller, Zeder, and Arter 2009; Zeder and Arter 1994) give rise to the typical problems associated with zooarchaeological meta-analyses (Atici et al. 2013). The Dandoy dataset was coded following the *D.A.R. Faunal Analysis Encoding Manual* (Brown and Bowen 1995) and had to be converted to a more common coding scheme. After the conversion, most basic primary archaeozoological data (i.e. taxonomic identifications, elements, portions, and fusion data) necessary to outline animal husbandry regimes and the faunal landscape were found to be comparable between the Dandoy and Çakırlar datasets. Some variables were not comparable or missing, however. Tooth eruption and wear was not scored following common and reproducible schemes (e.g. Grant 1982; Payne 1973). Furthermore, observations on weight-induced arthropathies on cattle, a potential measure of cattle’s use as labour (Bartosiewicz, Van Neer, and Lentacker 1997), were missing in the Dandoy dataset. All cattle autopodia (bones of hands and feet) and sheep, goat, sheep/goat, pig, and cattle mandibles with teeth were reanalysed by Çakırlar and recorded for tooth wear and eruption using the Grant (1982) scheme. To ensure comparability in taxonomic identifications, a random sample of bone bags were checked for the accuracy of identifications, and identifications proved comparable between Dandoy and Çakırlar.

Collection and identification of botanical remains

Systematic recovery of botanical remains has taken place at Gordion since 1988, although Roman levels were not encountered until 1993. Samples included here are those excavated by Voigt between 1993–2002 and by Goldman in 2004–2005 and date to Roman Phases 1–3 (c. 50–130 CE), contemporary with the bones described above (Marston and Miller 2014, 763–764). Sediment samples were taken for flotation, using a SMAP/Siraf-style flotation device (Nesbitt 1995; Pearsall 2015), from all features and many surrounding contexts identified during excavation. Ideal sample sizes are between 10–15 l, but mean sample size across the 26 Imperial Roman samples is 9 l, as some smaller contexts were collected in their entirety for flotation. Heavy fractions were retained in a 1-mm plastic mesh and light fractions were collected in a fine (< 0.1-mm mesh) polyester cloth. Wood charcoal was hand-collected when encountered during excavation, pulled from the sieving of all deposits (using 1-cm mesh), and analysed together with that from a subset of the flotation samples (Marston and Miller 2014).

Flotation sample light fractions were sorted using protocols consistent with other Gordion assemblages

(Marston 2017; Marston and Miller 2014; Miller 2010) and standard procedures (Fritz and Nesbitt 2014); all seeds and seed fragments larger than 1 mm were counted, weighed, and recorded, while below 1 mm only whole seeds and plant parts (e.g. cereal rachis fragments) were counted. Seeds were identified using modern comparative collections at Boston University and the University of Pennsylvania collected in large part from the Gordion region. Wood charcoal fragments larger than 2 mm and with at least one complete growth ring were identified by breaking transverse, and if necessary tangential and radial sections, and examined using a stereomicroscope at low magnification and an incident light microscope capable of 500× magnification. Wood was identified using comparative collections at Boston University and the University of Pennsylvania that include numerous taxa from central Anatolia, as well as published wood anatomy references (Schweingruber 1990; Wheeler 2011).

Analysis and interpretation of faunal remains

To assess the relative overall importance of domestic food animals in Roman Gordion, we use % of NISP (Number of Identified Specimens). This is the most common quantification unit in Eurasian archaeology and sometimes it is the only unit published from contemporary sites in Asia Minor, making it the only useful tool to make inter-site comparisons. As a rough measure of the contribution of different types of meat to the diet in the Roman garrison of Gordion, we use the relative proportion of bone weight. To show how the relative proportions of represented taxa differ in terms of NISP and bone weight in Roman Gordion, we compare the results to NISP and weight figures from the Hellenistic period Gordion, which immediately precedes the Roman occupation (Miller, Zeder, and Arter 2009). Comparing measures of taxonomic abundance with published data from roughly contemporary Pessinus, a nearby Roman settlement (De Cupere 1995), Sagalassos, a major highland city (De Cupere 2001; De Cupere et al. 2017; Frémondeau et al. 2017), and an assemblage from Roman houses in the coastal city of Ephesus (Forstenpointner, Galik, and Weissengruber 2010) allows us to assess the roles of different animals in Roman husbandry practices at Gordion in broader context. These data also inform the beef and pork debate introduced above by contrasting military (Gordion) with civic (Ephesus, Pessinus, Sagalassos) settlements.

Mortality profiles for sheep, goat, sheep/goat, and pig are reconstructed using the eruption and wear patterns observed on mandibles with teeth following Zeder (2006) for sheep and goat, and Lemoine et al. (2014) for pigs. There are very few cattle mandibles with teeth in the studied assemblage, thus we use long bone fusion data to reconstruct cattle mortality

following the age stage suggestions in Reitz and Wing (2008, Table 3.5). The use of non-metric traits on pelvises (cf. Greenfield 2006) and metrical traits of distal metacarpals of sheep, goat and cattle (cf. Davis et al. 2012) has been assessed to determine the sex of individuals with age estimations. Applying either method for pigs proved difficult because the great majority of pigs were culled before sexually dimorphic features were manifest and pig pelvises are not sexually dimorphic.

Finally, the prevalence of (possibly) draught-related deformations on cattle bones are assessed (following Bartosiewicz, Van Neer, and Lentacker 1997), as the use of cattle to plough fields is one indication of intensification of agricultural production.

Analysis and interpretation of botanical remains

Archaeobotanical macroremains recovered from flotation samples, primarily seeds and cereal rachis fragments, were tabulated by count and/or weight, as appropriate for the specific class of remains (Fritz and Nesbitt 2014), while wood charcoal fragments were tabulated by both count and weight following standard practices (Pearsall 2015); results have been presented in full in recent publications (Marston 2017; Marston and Miller 2014). In order to identify specific agricultural strategies and patterns of landscape change, simple statistics, primarily ratios, were developed to test specific hypotheses regarding land use (Marston 2014). These include the ratio of free-threshing wheat (bread and/or hard wheat) to barley, a measure of risk sensitivity in cereal agriculture (Marston 2011); the percentage of Cyperaceae among total wild seeds, a proxy for irrigation intensity (Miller and Marston 2012); the ratio of seeds to charcoal, a measure of dung versus wood fuel (Miller 1984; Miller and Smart 1984); and the ratio of wild seeds characteristic of healthy steppe grassland to those found in overgrazed steppe, a proxy of grassland health (Marston 2011, 2012), drawing on years of ecological survey in the region (Miller 2010). Relative proportions of woody species represented in the wood charcoal assemblage were used to identify woodland communities from which fuel wood was harvested and patterns of landscape clearance (Marston 2017).

Results

Animal husbandry

The meat supply to Gordion's garrison depended almost entirely on animal husbandry. Cattle, sheep and goats, pigs, and chickens provided meat, while horses, donkeys, and possibly mules were additional components of the animal economy (Table 1). Hares were present

Table 1. NISP and bone weights from Roman Gordion (this study), compared to Hellenistic Gordion (data from Miller, Zeder, and Arter 2009, 920).

TAXON	Hellenistic		Roman		Hellenistic		Roman	
	NISP (n)	Weight (g)	NISP (n)	Weight (g)	NISP %	Weight %	NISP %	Weight %
Cattle	105	3110	127	5475	8%	33%	11%	41%
Sheep/goat	960	1556	587	3915	71%	16%	52%	29%
Goat	42	1047	18	232	3%	11%	2%	2%
Sheep	55	2182	56	467	4%	23%	5%	4%
Pig	145	815	281	2080	11%	9%	25%	16%
Chicken	0	0	40	51	0%	0%	4%	0%
Horse/donkey/mule	27	731	13	1056	2%	8%	1%	8%
Hare	9	13	11	30	1%	0%	1%	0%
TOTAL	1343	9454	1133	13,306	100%	100%	100%	100%

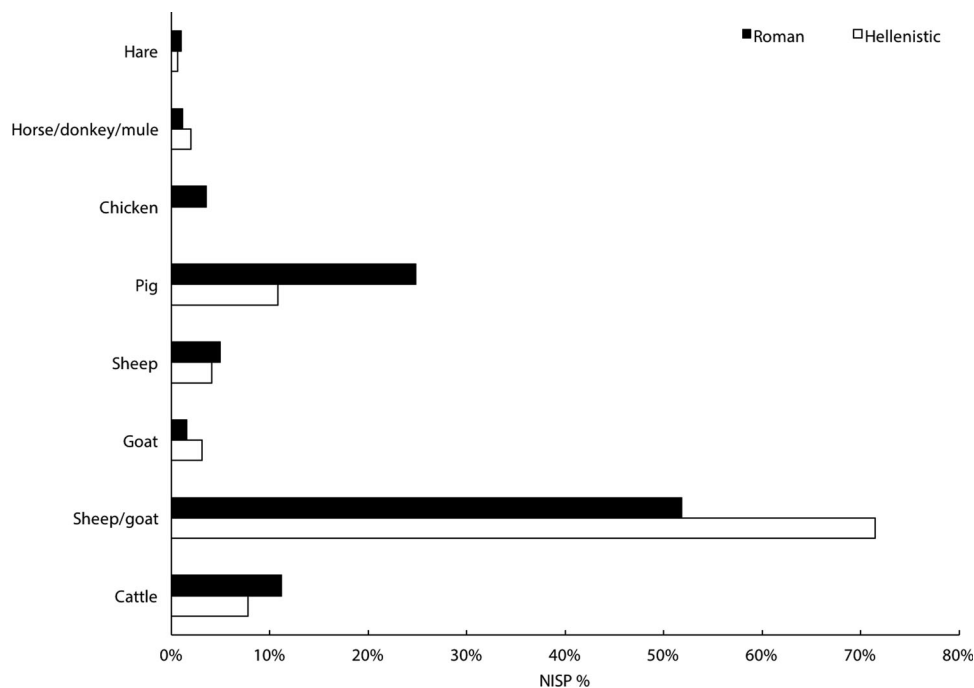
in the landscape and were occasionally hunted, but there is no indication that they were economically important. There are no clear indications, such as butchery marks, that equids were meat providers.

According to NISP proportions, no radical changes took place between the Hellenistic animal economy and the installation of the Roman garrison (Figure 3). Contrary to what Table 1 suggests, chickens do not appear suddenly in the Roman period in Gordion. Zeder and Arter, who conducted the analysis of the faunal material from the Hellenistic deposits excavated in 1988 and 1989 presented here, suggest that chickens were present in the bird bone material, but they do not provide absolute specimen counts (Zeder and Arter 1994, 114–115). Chickens had been around in the eastern Mediterranean since the 2nd millennium BC, but it was not until the Hellenistic Period that they became more frequent in faunal assemblages (Perry-Gal et al. 2015). It is clear, however, that dramatic increases in the relative proportion of chickens are markers of

Romanisation across Europe and the Mediterranean (Perry-Gal et al. 2015). It is likely that Roman Gordion is a case in point, however a detailed analysis of the Hellenistic bird assemblage is necessary to document this shift quantitatively.

More subtle changes, but visible even in the NISP proportions of represented taxa, involved pigs. As relative bone weight for each taxon indicates (Figure 4), pigs became a more significant meat provider in the Roman period. A largely different pig husbandry regime, visible in a remarkably different pig survivorship curve (Figure 5) made this possible. The garrison's pork was supplied primarily (>70%) by less than 1-year-old pigs. In the Hellenistic period, only ca 30% of the pork was supplied by juvenile pigs. It is highly likely that the Roman pigs were sty-kept either by the soldiers themselves or by specialised pig keepers nearby, and reared and culled intensively.

Beef also became relatively more prominent in the meat diet. The culling profile for cattle shows no

**Figure 3.** NISP proportions of animal bones from Hellenistic and Roman Gordion; data from Table 1. Total NISP counts: Roman = 1133, Hellenistic = 1343.

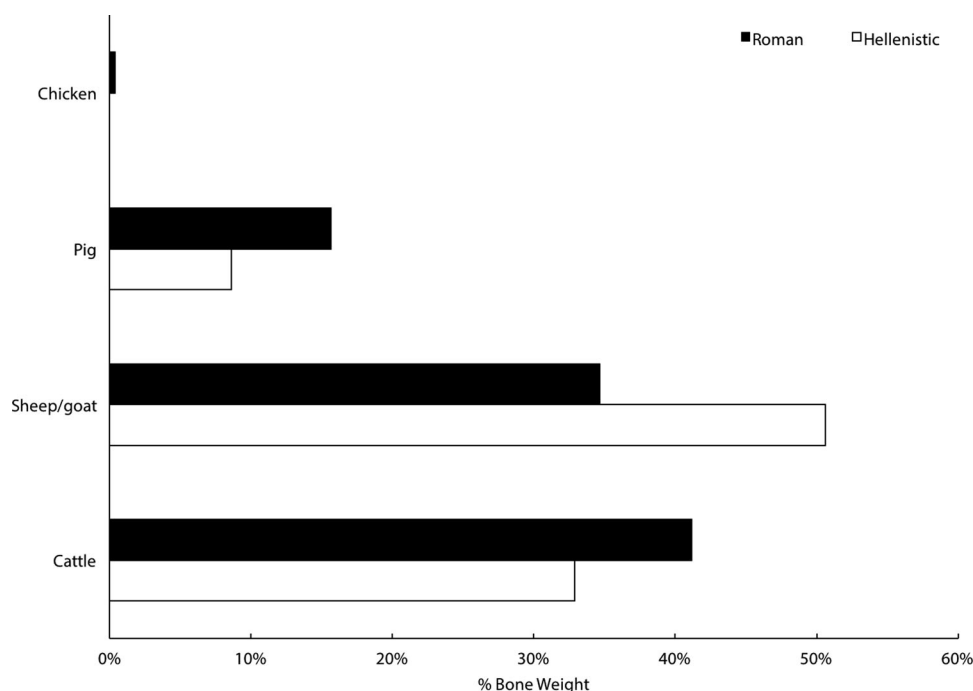


Figure 4. Bone weight proportions of animal bones from Hellenistic and Roman Gordion; data from Table 1.

evidence for intensive milk production (Figure 6). There are almost no neonate or infant cullings, but also no evidence for keeping cattle until old age, both of which can indicate dairying economies (Craig et al. 2005; Vigne and Helmer 2007). The four mandibles with teeth that survived display moderately worn teeth that represent adult but not very old individuals, according to age estimations proposed by Jones and Sadler (2012). The primary aim of keeping cattle – whether cattle were kept by the garrison or by herders provisioning the garrison –

appears to be beef production. Pathological marks on cattle bones that can be associated with cattle's use in traction (Bartosiewicz, Van Neer, and Lentacker 1997) are present both in the Hellenistic and Roman assemblages, but their frequency and severity is too low in the Roman assemblage to conclude that traction was a major role of cattle eventually consumed at Gordion in either phase.

Nevertheless, the most numerous species in the animal economy and key providers of primary and secondary

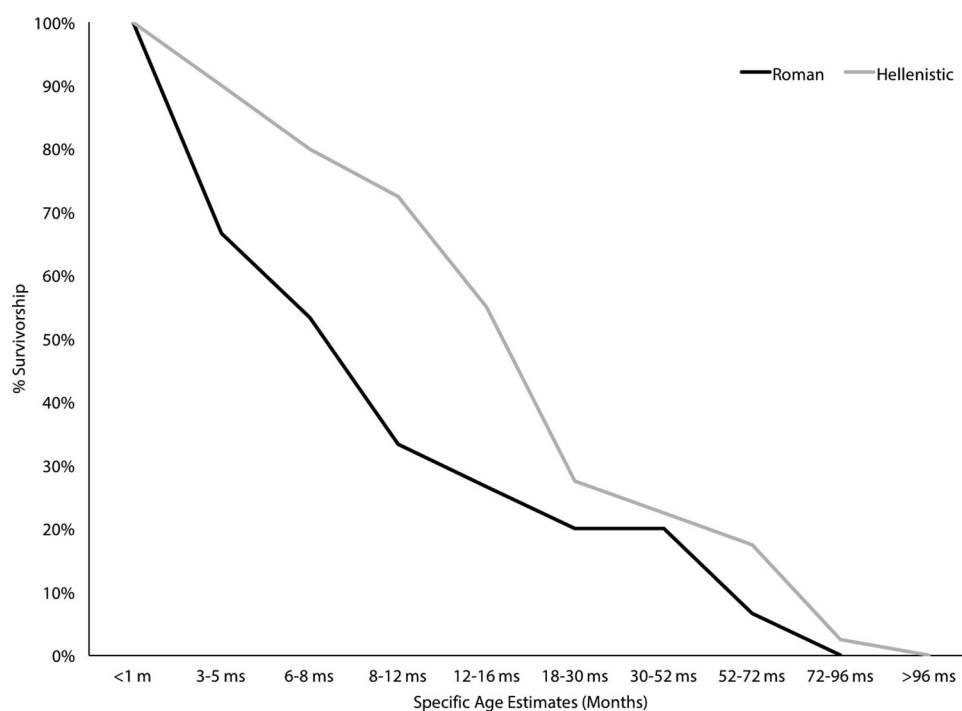


Figure 5. Percentage survivorship by age category for pigs, estimated following Lemoine et al. 2014. Total individual aged pigs: Roman = 15, Hellenistic = 40.

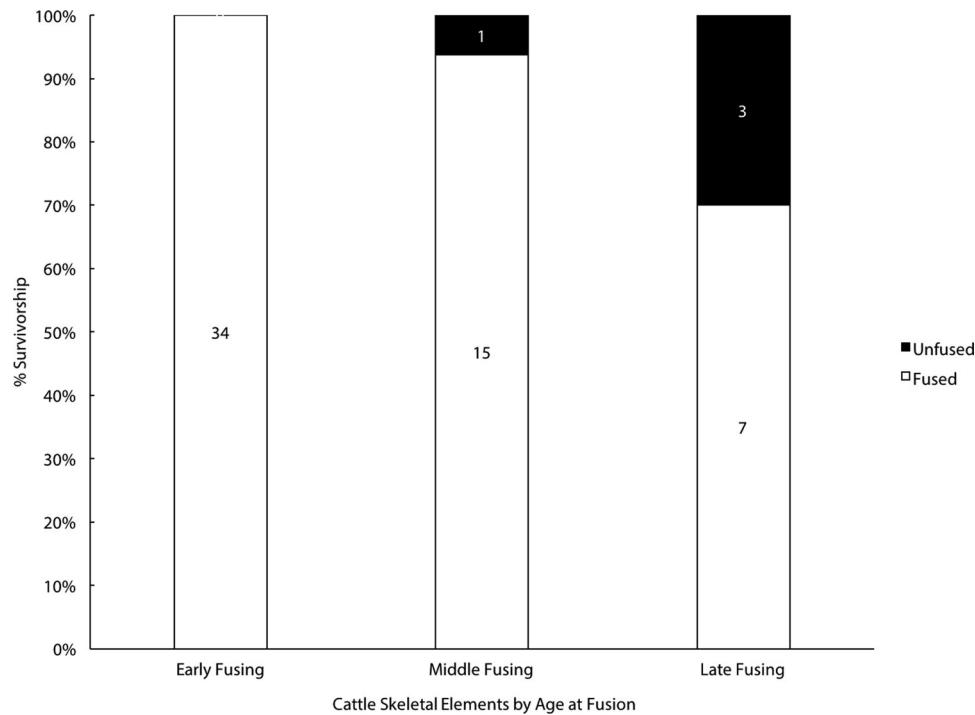


Figure 6. Percentage survivorship for Roman cattle based on long bone fusion, following Reitz and Wing 2008, Table 3.5.

products were sheep and goat. Sheep outnumbered goats, as in the Hellenistic period, although the ratio of sheep to goat rose substantially (3.1:1 for Roman, 1.3:1 for the Hellenistic). Their combined importance as meat providers diminished in the Roman period when compared to the Hellenistic period (Figure 4). Already in the Hellenistic period sheep and goat herding targeted milk and wool production, and also provided meat (Figure 7). Large but unfused acetabula are present in the assemblages,

indicating that juvenile males were culled for meat and herd management, as expected. Although female fused pelvises outnumber those of males (5 to 2), it is difficult to tell whether and what percentage of these belong to castrates. The goal of sheep and goat herding seems to have remained the same in the Roman Period, with perhaps even less emphasis given to meat production, based on the slightly older age structure of the meat supplied to Gordion.

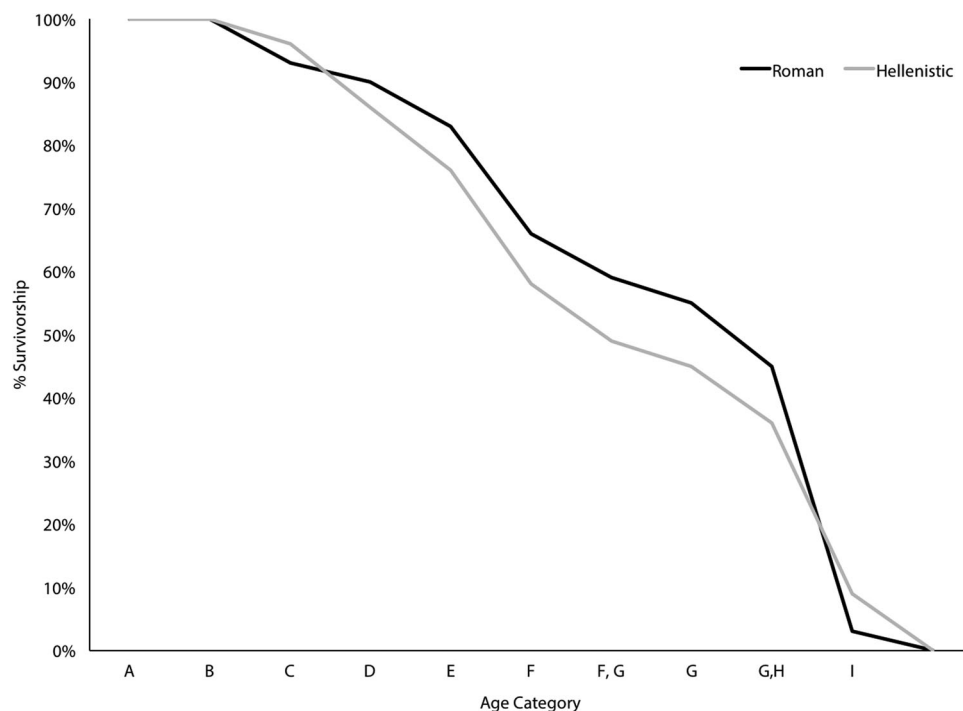


Figure 7. Percentage survivorship for sheep and goats; age categories follow Zeder 2006. Total individual aged sheep/goats: Roman = 29, Hellenistic = 272.

Farming and landscape change

The primary focus of regional farming during the Roman period was the production of free-threshing wheat: mostly likely bread wheat, *Triticum aestivum*, which has been definitively identified from cereal rachis fragments, but potentially also including hard wheat, *Triticum turgidum* ssp. *durum*. This strategy stands in contrast to earlier agricultural practices at Gordion where hulled barley (*Hordeum vulgare*) was more common. The ratio of barley to free-threshing wheat (by seed weight) during the Roman period is 0.84, compared to an average of 1.53 for samples from the Late Bronze Age (1400–1200 BCE) through the Hellenistic period (330–100 BCE), indicating a Roman emphasis on wheat production for direct human consumption (Marston 2017, 109). Other crops present in the Roman assemblage include foxtail millet (*Setaria italica*), the legumes bitter vetch (*Vicia ervilia*) and lentil (*Lens culinaris*), and a single grape (*Vitis vinifera*) seed (Marston and Miller 2014).

The ratio of seeds to charcoal, a proxy of dung fuel use, is low in comparison to earlier periods at Gordion: 0.023, compared to an average of 0.074 for Late Bronze Age to Hellenistic contexts (Marston 2017, 109). This indicates that less dung, and more wood, was used for fuel needs onsite. The primary fuel woods were oak (*Quercus* spp.; 50% of total by weight) and pine (*Pinus nigra*; 37%); juniper (*Juniperus* spp.; 9%) comprises most of the remainder with only small quantities of tamarisk (*Tamarix* spp.), elm (*Ulmus* spp.), ash (*Fraxinus* spp.), and willow or poplar (*Salix/Populus*) in single deposits (Marston 2017). The limited quantity of wood from open steppe grassland taxa (here, only elm) suggests that little landscape clearance took place in the Roman period within the immediate vicinity of Gordion and instead that only previously cleared land was used for agriculture (Marston 2017, 78).

The wild seeds that do originate from dung fuel indicate animal diet and landscape condition during the Roman period. The ratio of plants typically found in healthy steppe compared to those that remain in heavily overgrazed areas (antipastoral species) is much lower during the Roman period (mean value 1.2) than in earlier periods (mean value 17.3 from the Late Bronze Age through Hellenistic), indicating significant overgrazing; moreover, both the mean and median values during the Roman period are lower than any single prior period (Marston 2017, 109). In addition, plants from the sedge family (Cyperaceae), which predominantly grow in wet environments, increase in frequency around irrigation canals and in irrigated fields. The ratio of Cyperaceae seeds relative to total wild seeds serves as a proxy measure of irrigation intensity (Miller and Marston 2012). Cyperaceae comprise 32% of the wild seeds from the Roman

period, higher than any prior period, indicating intensive irrigation (Marston 2017, 109).

Discussion

Reconstructing the Roman agricultural economy at Gordion

Botanical data suggest that the economy that supported the Roman garrison at Gordion was intensive, including a focus on irrigated wheat agriculture. A similar intensification of the animal husbandry regime is evident, especially in pig and sheep and goat culling profiles. Pigs were managed within or close to the settlement, which provided a convenient and reliable meat supply for the garrison, and improved irrigation must have affected sty-keeping positively.

Sheep and goat herding was similarly intensive. Individuals were kept alive for a long time and herds provided a steady supply of meat (rarely of high quality), milk, and wool. As textual resources suggest (Mitchell 1993, 146), wool/fleece were market products and a likely source of taxable revenue in Central Anatolia. Pastoralism in the territory of Gordion was heavily dependent on wool production prior to Roman expansion into the region and did not re-tune sheep/goat herding strategies to supply the Roman garrison with meat. On the contrary, if anything sheep/goat herding became more intensive and more focused on the production of secondary products, especially wool. Those animals may have been kept further from Gordion, based on the diminished use of dung as fuel on site, further removing them from the urban meat supply. These large pastoral herds of sheep and goats were likely one of the guilty parties in overgrazing local pastures, although cattle may have played a significant role as well.

The limited supply (and quality) of lamb and mutton was compensated by an increase in the production of locally raised pork, beef, and the expansion of the role of chicken in the diet. Although there is no indication that cattle were not on-the-hoof when they were brought to the settlement to be slaughtered, there is very little indication that these were the working cattle. Beef from relatively younger animals may have been provisioned to the garrison rather than owned by the garrison, and we cannot eliminate the possibility that any number of cattle may have been imported. Currently, data is not sufficient to argue for a significant increase in the use of cattle in agriculture and/or other forms of traction, e.g. transport of goods, as was shown for Early-Middle Imperial (25BC to 300 AD) Sagalassos (De Cupere et al. 2017; De Cupere et al. 2000).

Gordion within Roman Anatolia

Direct comparison of the Gordion faunal assemblage with Pessinus, Sagalassos, and Ephesus is limited to

NISP proportion comparisons, due to the limited data available from Pessinus. Overall, the meat animals consumed at those sites match those of Gordion, but proportions differ (Figure 8). Each of these sites includes more cattle, over 30% by NISP at Sagalassos, and fewer sheep and goats. Pessinus, also on the Anatolian Plateau, has a similar proportion of sheep and goats to Gordion, but fewer pigs. Sagalassos has a similar frequency of pig bones to Gordion, while Ephesus has many more, nearly 50% of the assemblage by NISP. Many of these differences can be attributed to climate: the Lake District near Sagalassos and the Mediterranean coast by Ephesus are wetter and support more vegetation, both critical for cattle and the former for pigs, than the Central Anatolian Plateau.

Pessinus presents a more interesting comparison, given its climatic similarity and proximity to Gordion. The apparent difference in the relative proportion of pigs at Early Roman Pessinus and Roman Gordion could support the argument that the military had differential access to pork. Pork was a highly valued meat in the west (White 1970, 277–278) and if that system of value was shared throughout the empire, we see here that the military garrison of Gordion was able to provision pork despite the cost. Pessinus compares favourably to Gordion in other ways, however, with sheep outnumbering goats by a similar 3:1 ratio and sheep and goats kept to old ages (De Cupere 1995, 161). This suggests that the same rural pastoral economy devoted to wool production that we observe in the area around Gordion provisioned Pessinus as

well. One difference lies in the cattle remains, as those at Pessinus appear to have included working cattle slaughtered old (De Cupere 1995), in contrast to the younger cattle with a lack of traction pathologies at Gordion, although more data from both sites is needed to verify this distinction. This suggests that the Gordion garrison had access to a dedicated source of beef cattle, rather than eating worn-out old cattle following their useful life working the fields. This is evidence for provisioning and indicates the simultaneous existence of at least three distinct meat economies at Gordion: (1) pigs and chickens, raised onsite or close by; (2) beef cattle, likely raised specifically to provision the garrison; and (3) old mutton, available on a regular basis from herders who lived at some greater distance from Gordion and did not adjust their wool-focused economy to cater to the dietary needs of Roman soldiers.

Sagalassos is the only comparison available for Gordion with regard to the farming system. The Roman period at Sagalassos sees a significant increase in the production of bread wheat instead of hulled barley compared to Hellenistic levels at neighbouring Düzen Tepe (Fuller et al. 2012, 162), similar to the pattern observed at Gordion (Marston and Miller 2014, 767). Using an isotopic measure of animal diet, Fuller et al. (2012, 167) suggest that local grassland compositions changed as a result of grazing pressure at Sagalassos, similar in type, though maybe not in scale, to the overgrazing evident at Gordion. Botanical data from Pessinus and other Roman sites in Anatolia is needed to

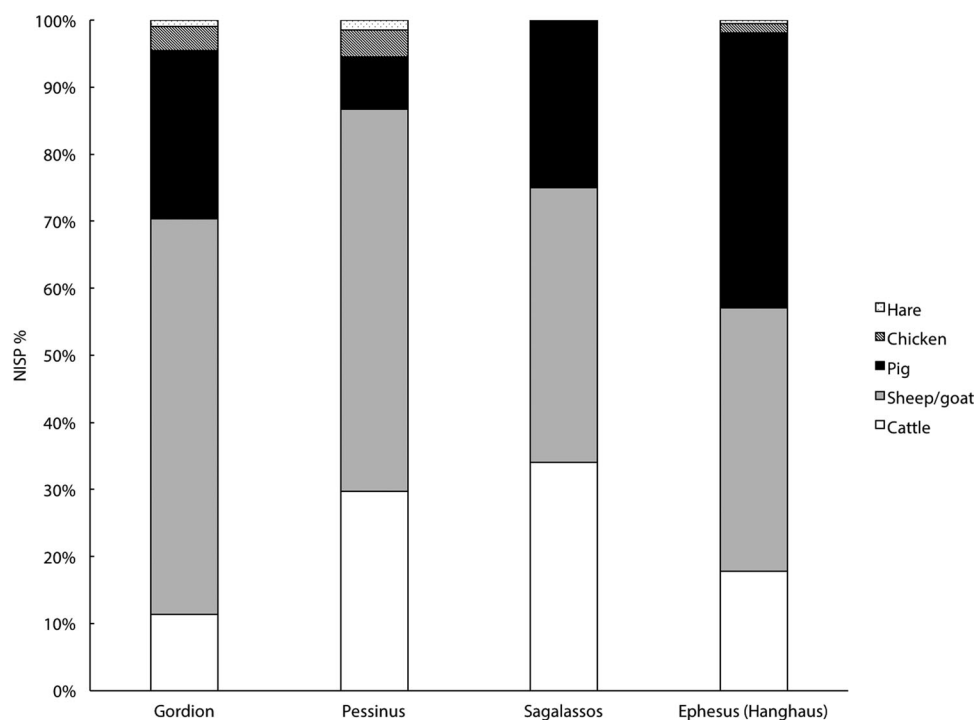


Figure 8. NISP proportions of animal bones from Roman sites in Anatolia. Data from Gordion (Roman Phases 1–3; this study), Pessinus ('Early Roman'; De Cupere 1995), Sagalassos ('Early-Middle Roman'; De Cupere 2001), and Ephesus ('Hanghaus 2, Fundgruppe B'; Forstenpointner, Galik, and Weissengruber 2010).

evaluate ways in which farming on the plateau may have varied spatially within a single climatic zone.

Conclusions

At Gordion we find evidence that provides support for both hypotheses laid out earlier: the garrison was provisioned with some high-value agricultural products (beef, pork, wheat) but also was directly involved in aspects of local agricultural production in ways similar to other garrisons in the Roman East. The garrison adapted to local systems by changing its dietary preferences, but maintained its traditional meat supply of pork, beef, and chickens as well. There is evidence for economic interdependence with local farmers and cattle herders, self-sufficiency in pork and chicken production, and complex relationships with autonomous sheep and goat herders who pursued their own economic goals, as seen during earlier periods in Anatolia (e.g. the Bronze Age [Arbuckle 2012]). If the Roman military in Gordion exercised a command economy, they were able to implement that control only on specific components of the agricultural sector, especially cereal farming. They changed almost nothing about the sheep and goat herding system, which appears to have been highly mobile and targeted secondary products for a market economy and/or broader provincial taxation authorities. The garrison added new elements to the animal economy of the Gordion region, including a new pig husbandry system. Whether these were entirely different than what was going on in non-military settlements (rural or urban) is not entirely clear, at least not in the case of Anatolia. Further isotopic and microbotanical work (cf. Frémondau et al. 2017; Fuller et al. 2012; Weber and Price 2016) is necessary to test the hypothesis of a radical change in pig husbandry, from herding to sty-keeping. Biometric, and potential genetic, analysis will allow the identification of new breeds of domestic animals that may have been introduced, as observed in other parts of the Roman world (MacKinnon 2001, 2010; Ottoni et al. 2013). Additional botanical datasets from Roman Anatolia will allow further comparison regarding the range of agricultural strategies practiced, especially on the Central Anatolian plateau, and their environmental implications. Finally, publication of environmental archaeological research from more Roman military sites in the East is needed to extend the conclusions drawn here about Gordion and further distinguish the rural and military economies of the Roman East.

Acknowledgements

We thank excavation directors Mary M. Voigt and Andrew Goldman, and Gordion project directors G. Kenneth Sams and C. Brian Rose, for access to, and insights into the

interpretation of, the samples discussed here. Naomi Miller analysed the flotation samples excavated in 2004 and 2005 by Goldman. Miriam Post and Janine van Noorden assisted the faunal analysis in 2013 and 2015, respectively. We finally thank Naomi F. Miller and two anonymous reviewers for helpful comments on earlier versions of this article.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Botanical research at Gordion has been supported by the US National Science Foundation [BCS grant number 0832125], the Council of American Overseas Research Centers, the American Philosophical Society, and Boston University. Faunal research has been funded by the Gordion Archaeological Project, a University of Pennsylvania Museum of Archaeology and Anthropology project since 1950, and the Groningen Institute of Archaeology.

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